Borko, H., Eisenhart, M., Brown, C. A., Underhill R. G., Jones, D. & Agard P. C. (1992). Learning to teach hard mathematics: Do novice teachers and their instructors give up too easily? *Journal for Research in Mathematics Education* 23 (3) 194-222.

Remarks to the Nuffield Seminar Session at Manchester University

Being one of the first of the last two presenters of the day brings with it the familiar situation: the comments that I had planned have been made by others in their discussion of the previous two papers. So I will begin by reiterating those:

- As Johannes has pointed out, the difficulty that Ms Daniels – the teacher on the ropes, as it were in this paper – would be one which many of his reasonable mathematics graduates share. So, it is by no means surprising that Ms Daniels, although fairly proficient in undergraduate mathematics, should have difficulty in providing an explanation of the division of fractions algorithm that her pupil, Elise, requested. Nevertheless, for that very reason it is worth dwelling on the policy that her training institution had in giving her some remission from her professional training course on the basis of what they assumed her mathematics course would have given her.
- Lara in her presentation was critical of the value assumptions that the paper made about good practice or what we might more commonly call nowadays "effective practice". In Borko's paper Ms Daniels had also imbibed these kinds of received views: these concerned making mathematics *relevant* and making it *meaningful*. Both of these could be stated by Ms Daniels but she did not have the wherewithal to make them easily happen.
- Anne Watson made some interesting points about Confucius which, if I understand them almost partly correctly, concerned roughly the idea that in teaching mathematics having an antecedent explanation or theory is not the complete solution for knowing what to do. Coming to know arises importantly with intelligent practice. There is almost some truth then in those teachers and students who are less concerned with so-called conceptual knowledge than we might like them to be and who say the understanding will come to children as they practice the procedures. (I think Robert Recorde believed something like this) It is also found in the important Aristotelian idea of moral education beginning with some kind of habituation. Anyway, Ms Daniels also seems to think that repetition is the key. She writes on page 210, for example, "I just need more practical experience of being in front of the class and being put on the spot and just thinking on my feet …"

These points aside the paper is an excellent example of what we have called in the SKIMA project *contingent* action and is one of the four pillars of our "Knowledge Quartet". The part which most interested me was the question of what an explanation

is and the authors of this paper devote some space to proposing an analysis of this which shows how a teacher can be led astray by offering to the pupil what s/he does not seek.

The paper, of course, forms only a part of a large project and the boxes on page 200 outline its scope. However, since the papers scarcely makes any reference to Box 4 “[Public] School Experience I hand over to Sandy at this point to show how such a consideration might have implications for the conclusions of this part of the authors project.

Peter Huckstep 3/5/07